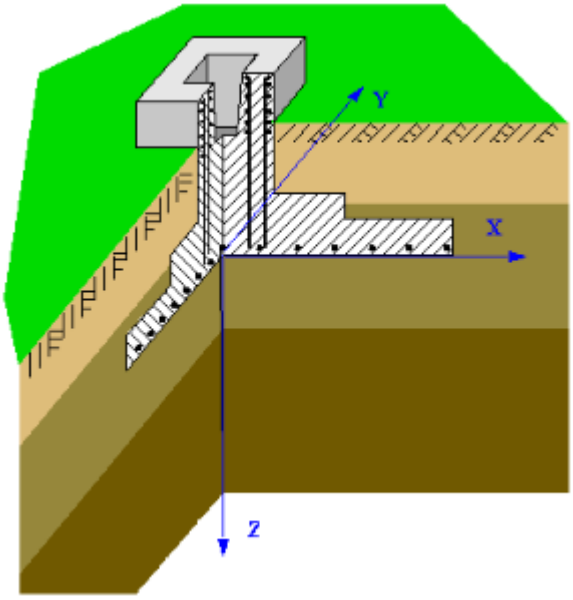
Pos. t534 **Столбчатый фундамент**

t534 - Отдельный фундамент под колонну (MSZ EN)



Программа предназначена для проектирования отдельного фундамента под стальную или железобетонную колонну согласно следующим Венгерским нормам:

MSZ EN 1997-1, MSZ EN 1992-1-1-2005.

Предусмотрено два типа сопряжения железобетонной колонны с фундаментом: монолитное и заделка колонны в стакан, стальная колонна считается опирающейся на стальную плиту.

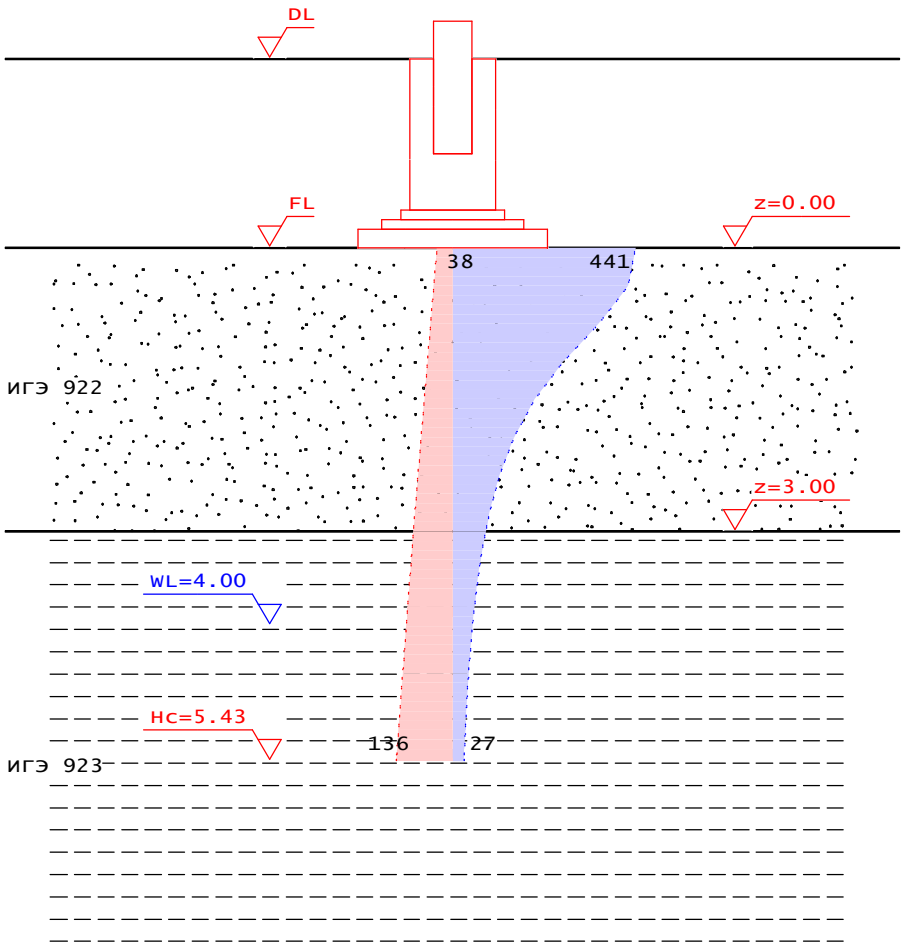
Расчётные сочетания нагрузок от колонны (продольная и поперечные силы и моменты) определяются в соответствии с MSZ EN 1990:20011.

Проводятся расчёты основания по несущей способности, осадке и крену, расчёт плиты на продавливание и проектирование ступенек. Подбирается продольная арматура плиты и стакана или подколонника, а также поперечная арматура стакана и косвенная арматура, препятствующая смятию дна стакана..

Data for calculation

Layout of soil layers

M = 1 :80



Ground

N	Layer	Type of ground in layer
1	ИГЭ 922	Песок средней крупности
2	ИГЭ 923	Глина
3	ИГЭ 921	Крупный песок
4	ИГЭ 924	Суглинок

Norm. values of characteristics by layers.

type	z [m]	g [kN/m³]	E [MPa]	fi [grad]	c/Rc [kPa]	e [%]	IL
ИГЭ 922	0.00	19.0	45.0	39.0	2.0	40.0	
ИГЭ 923	3.00	17.0	17.0	17.0	48.0	40.0	0.40
ИГЭ 921	8.00	18.0	30.0	38.0	2.0	40.0	
ИГЭ 924	12.00	17.0	14.0	18.0	19.0	40.0	0.52

Inputed sizes

Part	sizes by X & by Y [cm]	height/depth [cm]	h/dc
plate	200.0 200.0	20.0	
pedestal	90.0 90.0	180.0	
column	40.0 40.0	100.0	

Footing height from the sole 200.0 cm

Actions

№	Duration	Description
1	Permanent	Постоянное воздействие постоянное -
2	Variable	Категория А: жилые здания переменное Категория-А

Characteristics

№	γ_F	ξ	ψ_0	ψ_1	ψ_2	group несоч.	sign
1	1.35	0.85					
2	1.50		0.70	0.50	0.30		

Factor for reliability differentiation K_{FI} = 1.00

Combination of actions by formula (6.10) EN 1990

Loads

N	Load	N [kN]	Mx [kN*m]	My [kN*m]	Qx [kN]	Qy [kN]
1	постоянное -	1000.0	0.0	0.0	0.0	0.0
2	переменное Категория-А	2000.0	2.0	2.0		0.0

Load combinations

Combinations by MSZ EN 1990:2011

Forces & moments

for critical combinations on height H from sole.

N	Type Comb	tabl. coef.	N [kN]	Mx [kN*m]	My [kN*m]	Qx [kN]	Qy [kN]
1	q.per.	1	1600.0	0.6	0.6	0.0	0.0
2	fund.	2	3000.0	2.0	2.0	0.0	0.0
3	fund.	3	4350.0	3.0	3.0	0.0	0.0
4	fund.	4	4000.0	3.0	3.0	0.0	0.0

Critical combinations

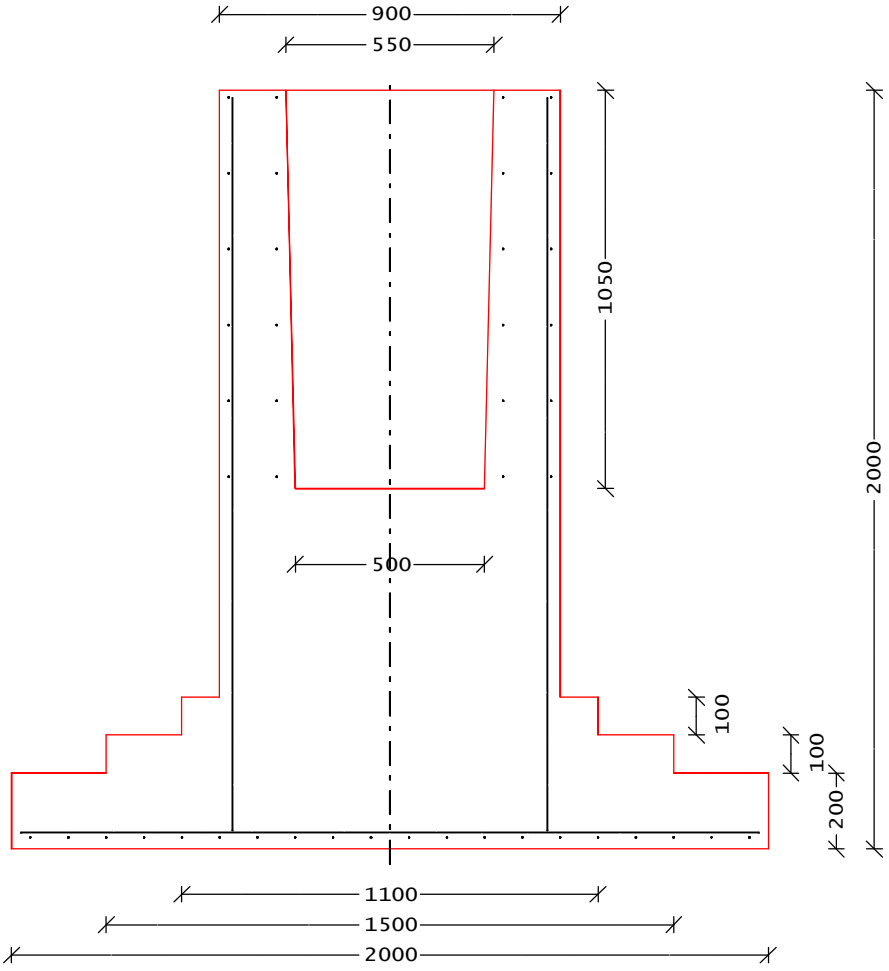
Actions	Comb. coefficients 1	2	3	4	Actions	Comb. coefficients 1	2	3	4
1	1.00	1.00	1.35	1.35	2	0.30	1.00	1.50	0.00

Results

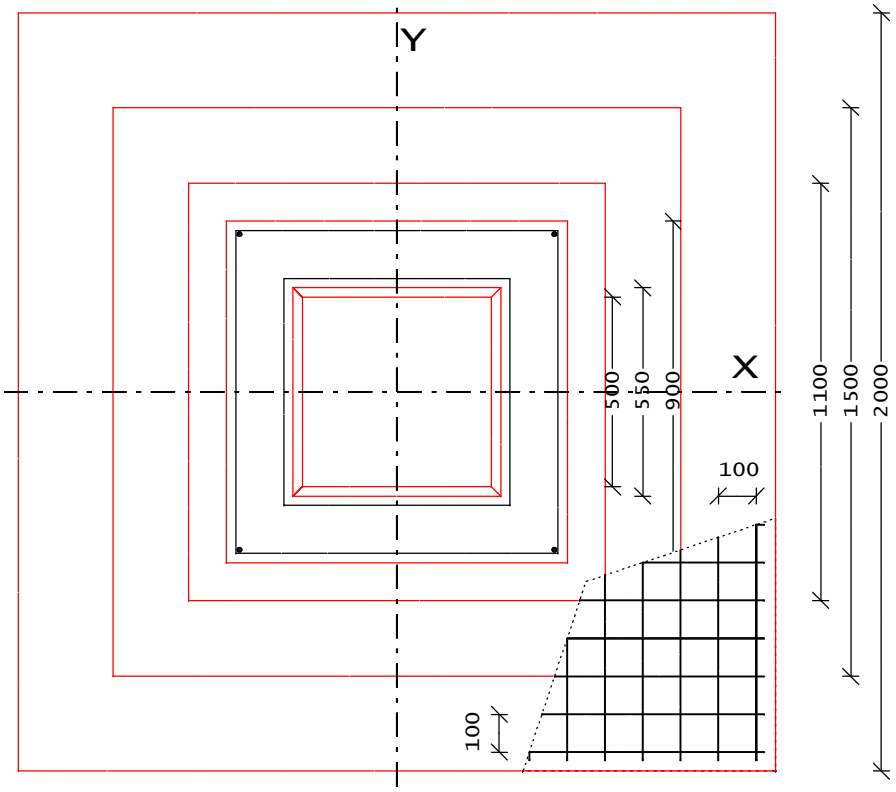
of calculation footing sizes.

Part	sizes by X [cm]	& by Y [cm]	height h [cm]
plate 1	200.0	200.0	20.0
plate 2	150.0	150.0	10.0
plate 3	110.0	110.0	10.0
pedestal	90.0	90.0	160.0

Layout of footing side view
M = 1 :20



Layout of footing top view
M = 1 :20



Foundation calculat. Using scheme of a linearly deformed half-space.

Displacement calc.
Max settlement is reached at combination N 1.
The depth of the compressible layer is taken from
the condition $\sigma_{zg}=0.2*\sigma_{zp}$ Hc=5.43 m
Average pressure under the sole p=441.4 kPa
Eccentricities of resultant e_x=0.00 m
e_y=0.00 m
Edge pressure along the y axis p_y=441.8 kPa
Edge pressure along the x axis p_x=441.8 kPa
Pressure at the corner point p_{xy}=442.3 kPa
Footing settlement s=1.8 cm < s_u=5.0 cm
Max heel is reached at combination N 1,
Footing heel i=0.0000 < i_u=0.0050

Bearing resistance
using Design Approach 2, BS EN 1997-1 2.4.7.3.4.3
and analytical method given in Annex D.
The most dangerous in squeezing is the comb. N 3.
Partial resistance factor γ_{R2}=1.40
Maximal depth of sliding surface z_m=3.53 m
Slip domain averaged parameters of ground
γ=15.9 kN/m^3 φ=33.0 grad. c=16.6 kPa
Dangerous dir. along the Y axis, ecc. e_y=0.00 m
The reduced width of footing b'=2.00 m
Force of ultimate resistance of soil R=10612 kN
N=4537 < R/γ_{R2}=7580 CONDITION COMPLETED

Punching.

Calculation by item 6.4.4 MSZ EN 1992-1-1.
Concrete C30/37

Plate	Comb.	β	h_0 [cm]	u [cm]	V_{ed} [kN/m]	V_{rd} [kN/m]
1	3	1.02	16.1	678.1	968.55	1381.74
2	3	1.01	26.1	578.0	1211.48	1267.38
3	3	1.00	36.1	525.5	1164.45	1462.25

Reinforcement calc.

by MSZ EN 1992-1-1 using parabola-rectangle diagram for concrete under compression.

Plate reinforcement *Steel S500*

Axis of bar	Coord. [m]	Comb.	M_{bend} [kN*m]	h_0 [cm]	A_s [cm²]	d [mm]	n
X	0.75	3	68.1	15.7	9.9		
X	0.55	3	220.6	25.7	19.8		
X	0.45	3	329.5	35.7	21.1	12	20
Y	0.75	3	68.1	16.9	9.2		
Y	0.55	3	220.6	26.9	18.8		
Y	0.45	3	329.5	36.9	20.4	12	20

The bottom bars are oriented along the axis Y.

Transverse socket reinforcement *Steel S400*

Axis	Z [cm]	comb.	p [kN/m]	A_s/s [cm²/m]	s [mm]	d [mm]	n
Y	2.6	3	18.0	0.5	200	8	4
Y	22.6	3	9.9	0.3	200	8	4
Y	42.6	3	2.7	0.1	200	8	4
Y	62.6	3	4.5	0.1	200	8	4
Y	82.6	3	11.7	0.3	200	8	4
Y	102.6	3	18.0	0.5	200	8	4

Z coordinate is taken from upper edge of socket.

Longitudinal pedestal reinforcement: *steel S500*
Critical combination N4 . 4 bars, diameter 12mm, located at the corners.

Crack resistance

allowable crack width wk=0.3мм

Plate

Axis	Coord. [m]	Comb.	M_{bend} [kN*m]	M_{crc} [kN*m]	a_{crc} [mm]
X	0.75	1	25.0	39.5	0.00
X	0.55	1	81.1	81.9	0.00
X	0.45	1	121.1	132.4	0.00
Y	0.75	1	25.0	40.2	0.00
Y	0.55	1	81.1	82.8	0.00
Y	0.45	1	121.1	133.4	0.00